

Automotive-grade N-channel 40 V, 2.2 mΩ typ., 80 A STripFET™ F7 Power MOSFET in a DPAK package

Datasheet - production data

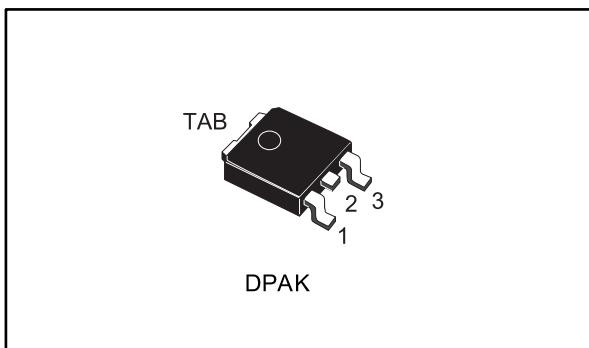
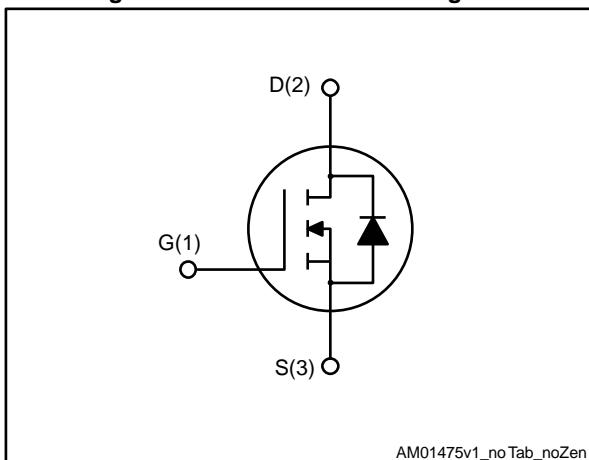


Figure 1: Internal schematic diagram



Features

Order code	V _{DS}	R _{DS(on)} max.	I _D	P _{TOT}
STD170N4F7AG	40 V	2.8 mΩ	80 A	172 W

- AEC-Q101 qualified
- Among the lowest R_{DS(on)} on the market
- Excellent FoM (figure of merit)
- Low C_{rss}/C_{iss} ratio for EMI immunity
- High avalanche ruggedness



Applications

- Switching applications

Description

This N-channel Power MOSFET utilizes STripFET™ F7 technology with an enhanced trench gate structure that results in very low on-state resistance, while also reducing internal capacitance and gate charge for faster and more efficient switching.

Table 1: Device summary

Order code	Marking	Package	Packing
STD170N4F7AG	170N4F7	DPAK	Tape and reel

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1 Electrical ratings

Table 2: Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage	40	V
V_{GS}	Gate-source voltage	± 20	V
$I_D^{(1)}$	Drain current (continuous) at $T_{case} = 25^\circ C$	80	A
	Drain current (continuous) at $T_{case} = 100^\circ C$	80	
$I_{DM}^{(2)}$	Drain current (pulsed)	320	A
P_{TOT}	Total dissipation at $T_{case} = 25^\circ C$	172	W
$E_{AS}^{(3)}$	Single pulse avalanche energy	460	mJ
T_{stg}	Storage temperature range	-55 to 175	$^\circ C$
T_j	Operating junction temperature range		

Notes:

(1) Current is limited by package.

(2) Pulse width is limited by safe operating area.

(3) starting $T_j = 25^\circ C$, $I_D = 40 A$, $V_{DD} = 25 V$.

Table 3: Thermal data

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case	0.87	$^\circ C/W$
$R_{thj-pcb}^{(1)}$	Thermal resistance junction-pcb	50	

Notes:(1) When mounted on a 1-inch² FR-4, 2 Oz copper board.

2 Electrical characteristics

($T_{case} = 25^\circ C$ unless otherwise specified)

Table 4: Static

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$V_{GS} = 0 V$, $I_D = 250 \mu A$	40			V
I_{DSS}	Zero gate voltage drain current	$V_{GS} = 0 V$, $V_{DS} = 40 V$			1	μA
		$V_{GS} = 0 V$, $V_{DS} = 40 V$, $T_{case} = 125^\circ C$ (1)			100	
I_{GSS}	Gate-body leakage current	$V_{DS} = 0 V$, $V_{GS} = \pm 20 V$			± 100	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$, $I_D = 250 \mu A$	2		4	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 10 V$, $I_D = 40 A$		2.2	2.8	$m\Omega$

Notes:

(1)Defined by design, not subject to production test.

Table 5: Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{DS} = 25 V$, $f = 1 MHz$, $V_{GS} = 0 V$	-	4350	-	pF
C_{oss}	Output capacitance		-	1430	-	
C_{rss}	Reverse transfer capacitance		-	80	-	
Q_g	Total gate charge	$V_{DD} = 20 V$, $I_D = 80 A$, $V_{GS} = 10 V$ (see Figure 14: "Test circuit for gate charge behavior")	-	63	-	nC
Q_{gs}	Gate-source charge		-	23	-	
Q_{gd}	Gate-drain charge		-	18	-	

Table 6: Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 20 V$, $I_D = 40 A$, $R_G = 4.7 \Omega$, $V_{GS} = 10 V$ (see Figure 13: "Test circuit for resistive load switching times" and Figure 18: "Switching time waveform")	-	35	-	ns
t_r	Rise time		-	40	-	
$t_{d(off)}$	Turn-off delay time		-	70	-	
t_f	Fall time		-	35	-	

Table 7: Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}^{(1)}$	Source-drain current		-		80	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		320	A
$V_{SD}^{(2)}$	Forward on voltage	$V_{GS} = 0 \text{ V}$, $I_{SD} = 80 \text{ A}$	-		1.2	V
t_{rr}	Reverse recovery time	$I_{SD} = 80 \text{ A}$, $dI/dt = 100 \text{ A}/\mu\text{s}$, $V_{DD} = 32 \text{ V}$ (see <i>Figure 15: "Test circuit for inductive load switching and diode recovery times"</i>)	-	50		ns
Q_{rr}	Reverse recovery charge		-	51		nC
I_{RRM}	Reverse recovery current		-	2.0		A

Notes:

(1) Current is limited by package.

(2) Pulse test: pulse duration = 300 μs , duty cycle 1.5%.

2.1 Electrical characteristics (curves)

Figure 2: Safe operating area

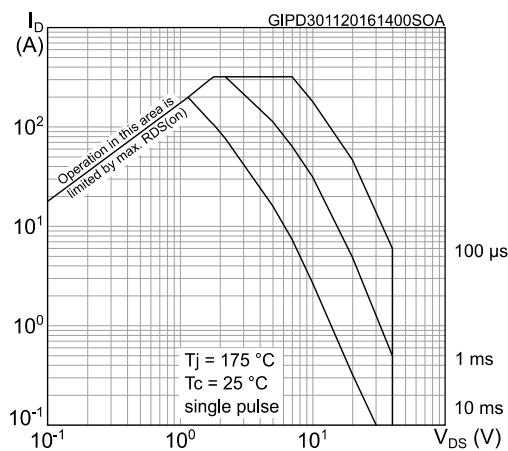


Figure 3: Thermal impedance

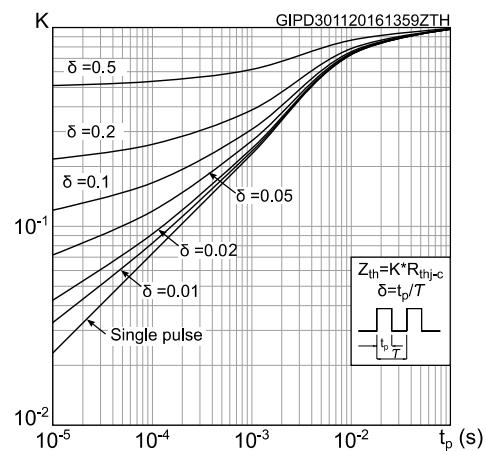


Figure 4: Output characteristics

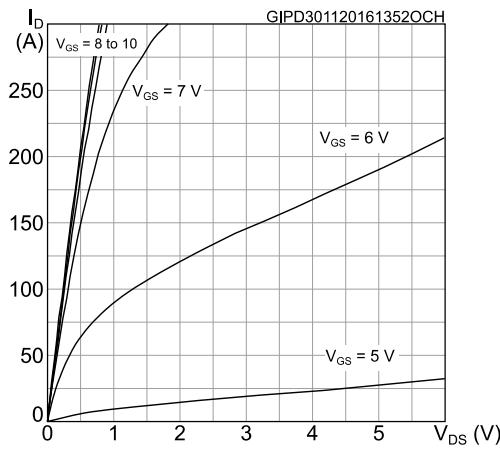


Figure 5: Transfer characteristics

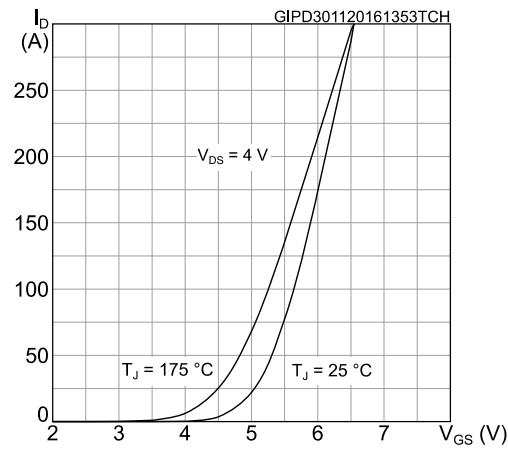


Figure 6: Gate charge vs gate-source voltage

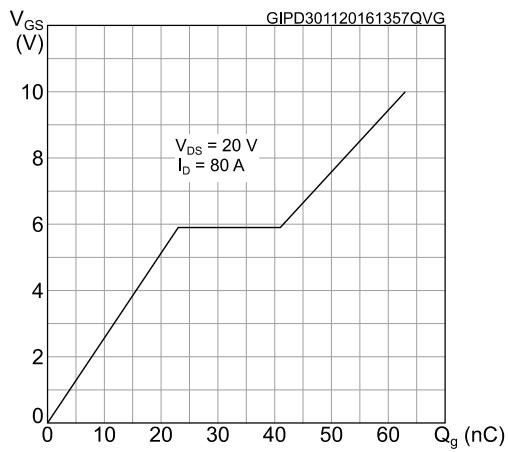


Figure 7: Static drain-source on-resistance

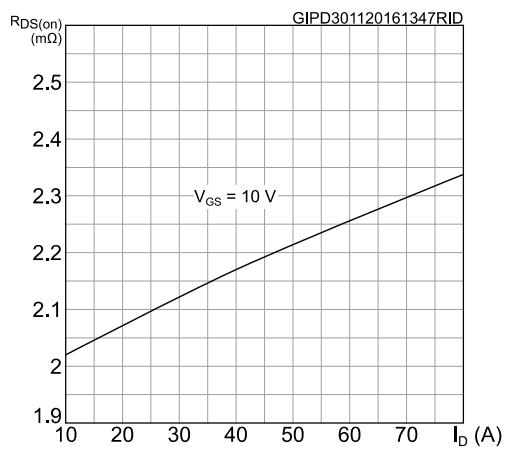


Figure 8: Capacitance variations

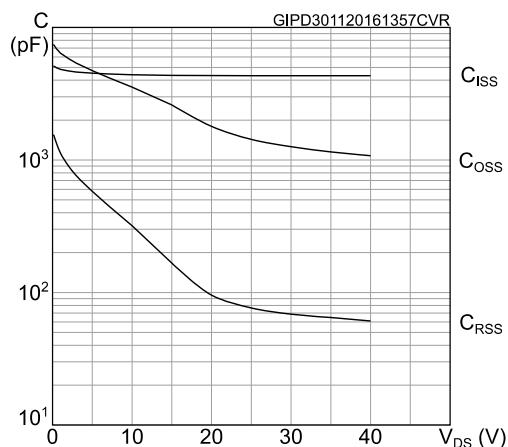


Figure 9: Normalized gate threshold voltage vs temperature

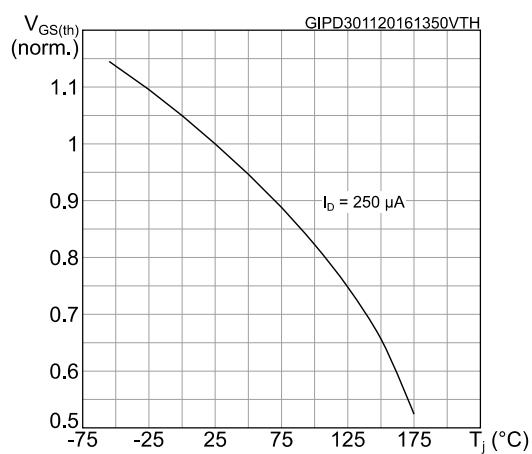


Figure 10: Normalized on-resistance vs temperature

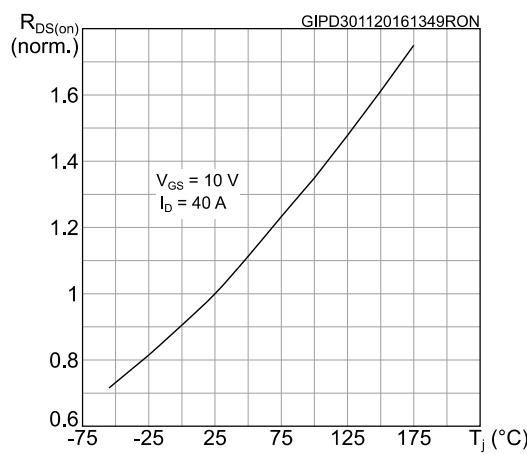
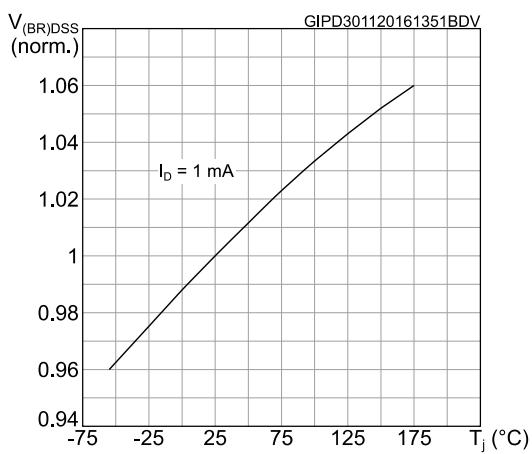
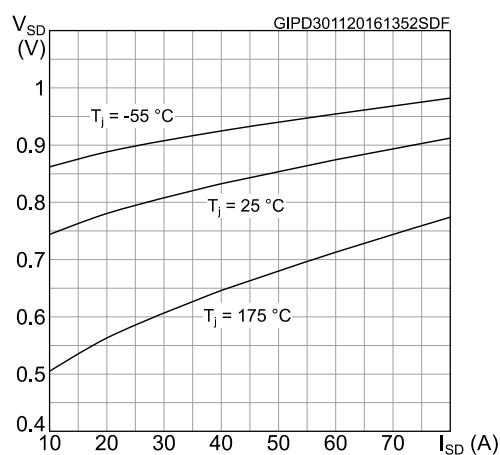
Figure 11: Normalized $V_{(BR)DSS}$ vs temperature

Figure 12: Source-drain diode forward characteristics



3 Test circuits

Figure 13: Test circuit for resistive load switching times

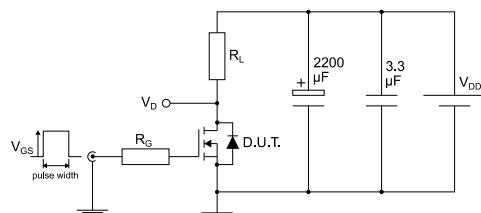


Figure 14: Test circuit for gate charge behavior

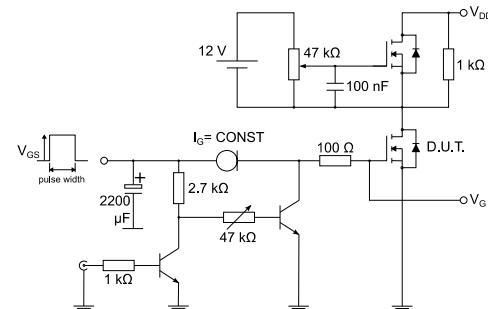


Figure 15: Test circuit for inductive load switching and diode recovery times

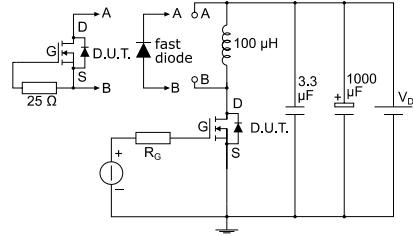


Figure 16: Unclamped inductive load test circuit

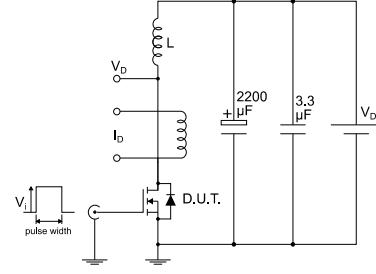


Figure 17: Unclamped inductive waveform

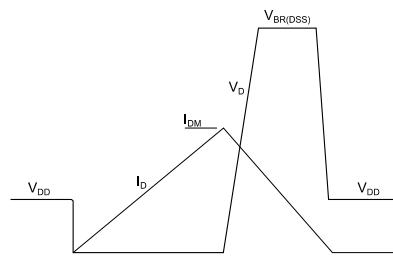
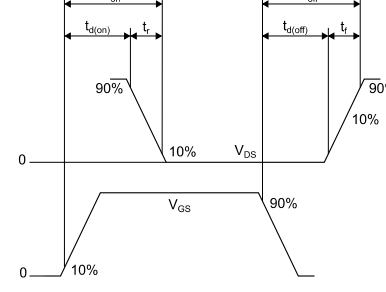


Figure 18: Switching time waveform



4 Package information

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: www.st.com. ECOPACK® is an ST trademark.

4.1 DPAK (TO-252) type A2 package information

Figure 19: DPAK (TO-252) type A2 package outline

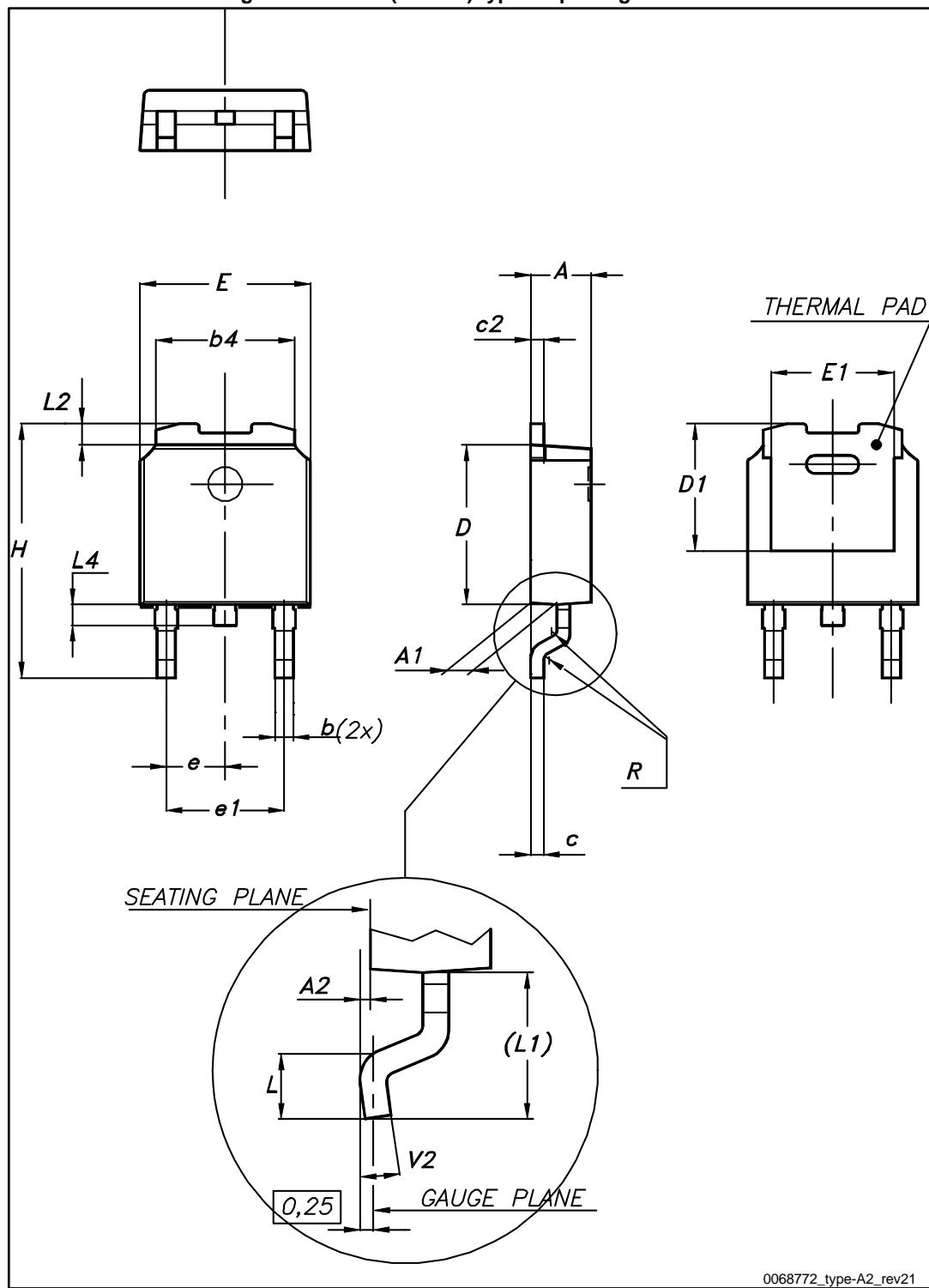
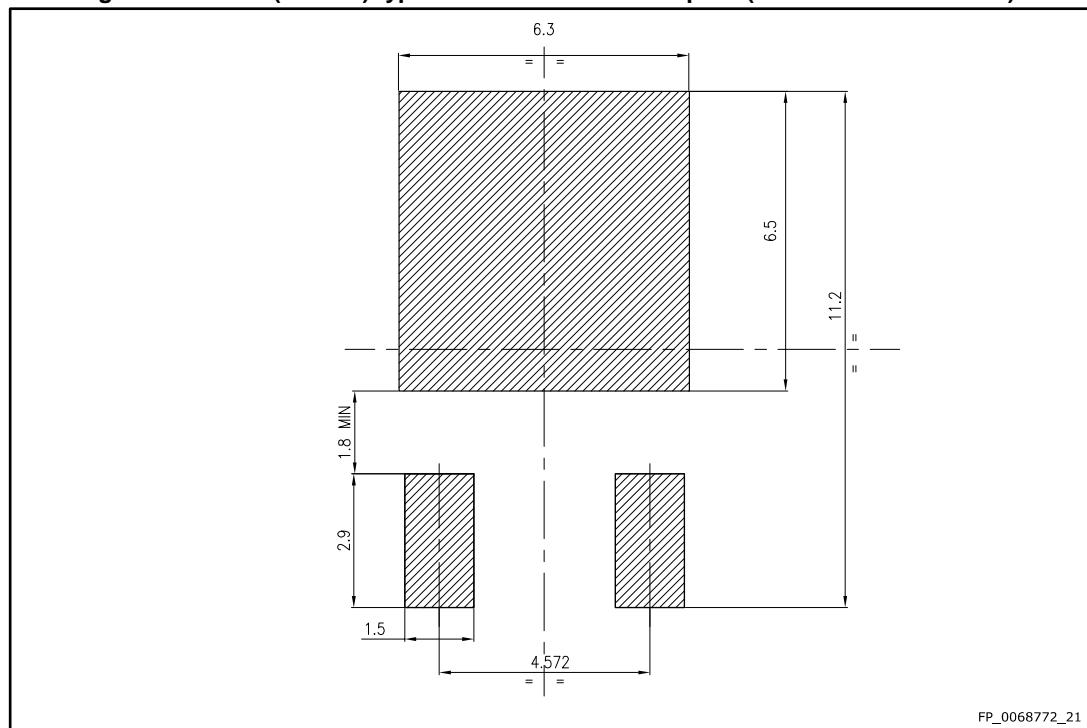


Table 8: DPAK (TO-252) type A2 mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	2.20		2.40
A1	0.90		1.10
A2	0.03		0.23
b	0.64		0.90
b4	5.20		5.40
c	0.45		0.60
c2	0.48		0.60
D	6.00		6.20
D1	4.95	5.10	5.25
E	6.40		6.60
E1	5.10	5.20	5.30
e	2.16	2.28	2.40
e1	4.40		4.60
H	9.35		10.10
L	1.00		1.50
L1	2.60	2.80	3.00
L2	0.65	0.80	0.95
L4	0.60		1.00
R		0.20	
V2	0°		8°

Figure 20: DPAK (TO-252) type A2 recommended footprint (dimensions are in mm)



4.2 DPAK (TO-252) type A2 packing information

Figure 21: DPAK (TO-252) tape outline

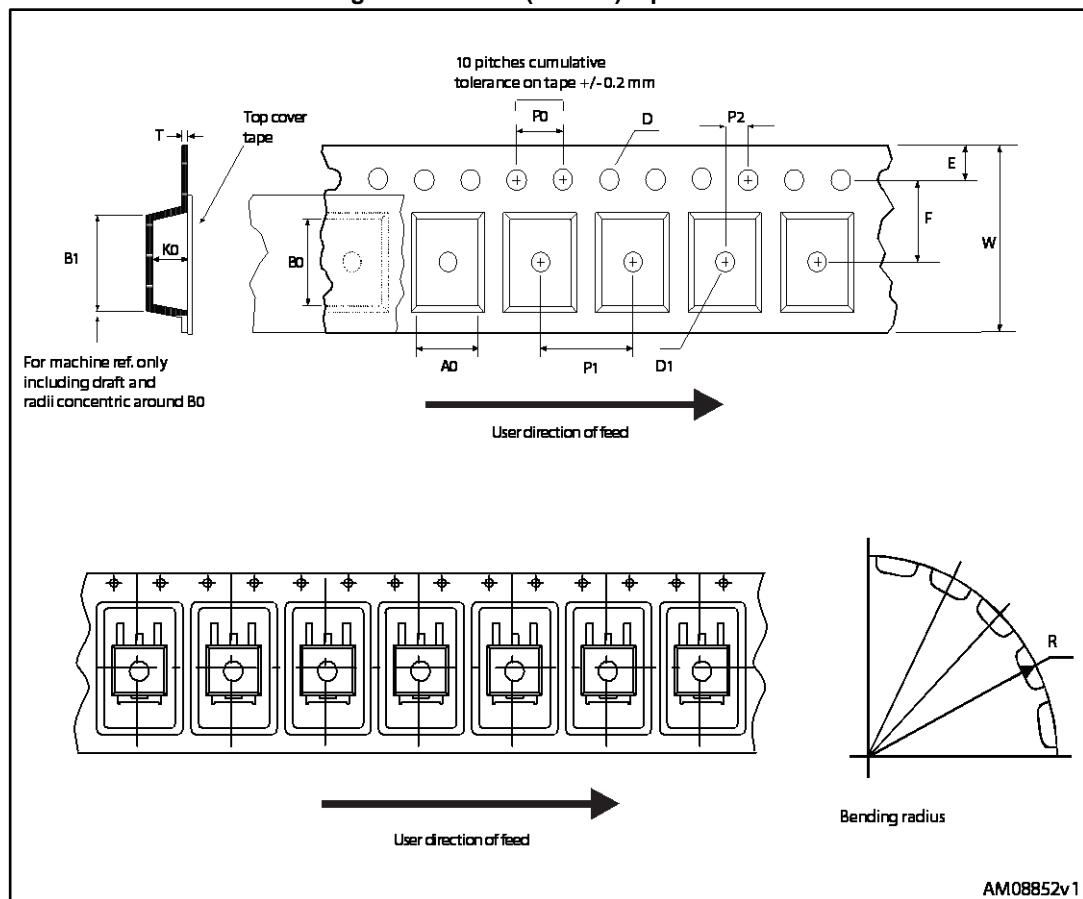


Figure 22: DPAK (TO-252) reel outline

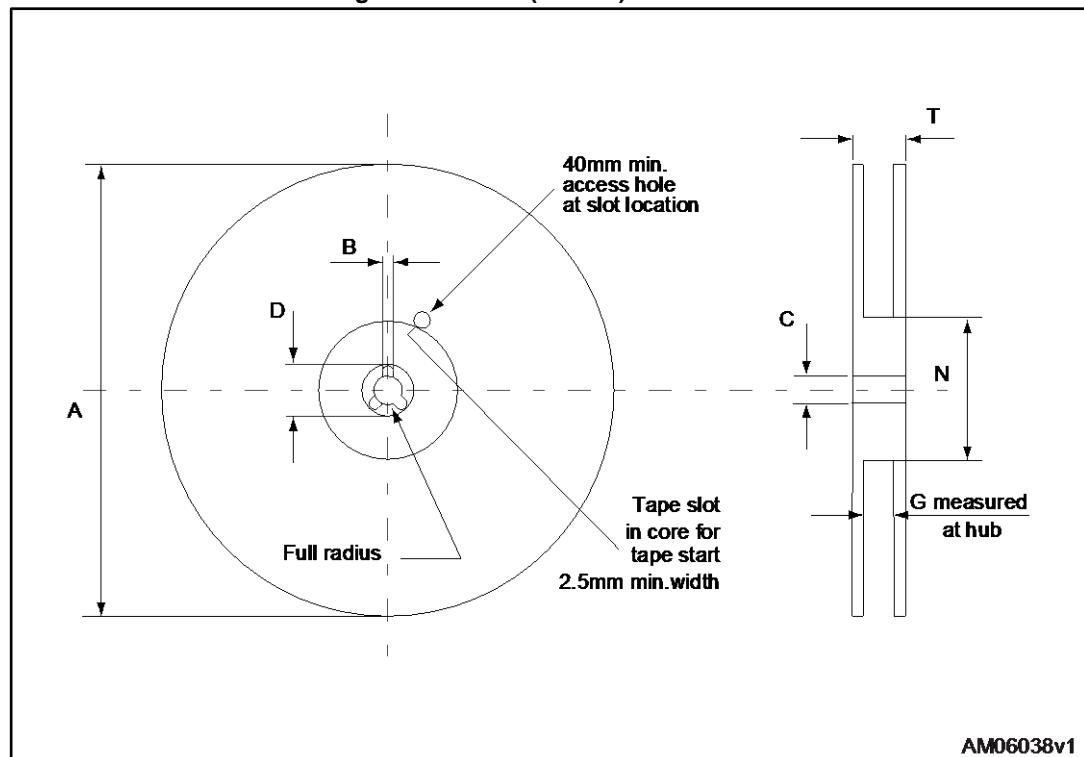


Table 9: DPAK (TO-252) tape and reel mechanical data

Tape			Reel		
Dim.	mm		Dim.	mm	
	Min.	Max.		Min.	Max.
A0	6.8	7	A		330
B0	10.4	10.6	B	1.5	
B1		12.1	C	12.8	13.2
D	1.5	1.6	D	20.2	
D1	1.5		G	16.4	18.4
E	1.65	1.85	N	50	
F	7.4	7.6	T		22.4
K0	2.55	2.75			
P0	3.9	4.1	Base qty.		2500
P1	7.9	8.1	Bulk qty.		2500
P2	1.9	2.1			
R	40				
T	0.25	0.35			
W	15.7	16.3			

5 Revision history

Table 10: Document revision history

Date	Revision	Changes
19-Dec-2016	1	First release.

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